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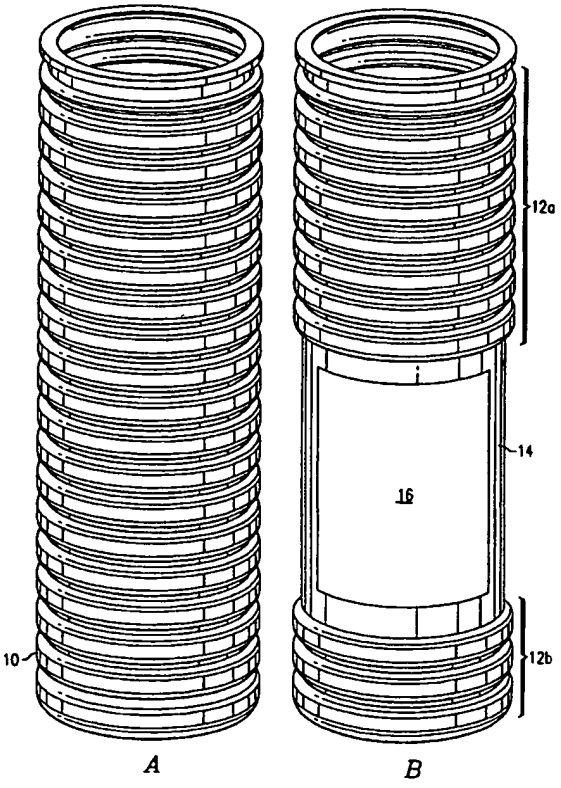
(54) Title: IMPLOSION RESISTANT CONTAINERS



(57) Abstract: The present invention overcomes many of the shortcomings inherent in previous containers for packaging potato chips, corn based chips, cookies and the like. The improved implosion-resistant container of the present invention utilizes a collection of stress dissipating mechanisms that counteract the forces causing thermoplastic container deformation, implosion and loss of seal integrity. This collection of stress dissipating mechanisms, employed collectively or separately, allows a container for storing fragile food products to be fashioned as a relatively lightweight, thinwalled blow molded thermo-plastic container that is capable of adapting to changing environmental conditions while maintaining its visual aesthetic appearance.

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APPLICATION FOR

UNITED STATES LETTERS PATENT

FOR

IMPLOSION RESISTANT CONTAINERS

BY:

Edward A. Bezek

BACKGROUND OF THE INVENTION

1. Technical Field:

The present invention generally relates to containers for storing fragile food products, and more particularly, to a blow molded container for storing potato chips, corn based chips, cookies and the like which is capable of adapting to changing environmental conditions while maintaining its visual aesthetic appearance.

2. Description of the Related Art:

There are presently a great number of containers known for the storage of fragile food products (*e.g.*, snack chips, cookies and the like). Inherent in every container's design is the requirement to compensate for or adapt to changing environmental conditions. Changes in environmental conditions (*i.e.*, temperature, pressure and humidity) are a natural consequence of manufacturing processes. For example, dry food products are typically manufactured at elevated temperatures and thereafter sealed to protect the product from spoiling. Once sealed, a certain amount of gas is trapped within the container. As the contents of the sealed package cool to an ambient temperature, a vacuum is created which may cause the container to implode, distort or destroy the seal.

Changes in atmospheric pressure also affect the volume of gas trapped within a container. This is normally not a problem for dry food products because they are typically packaged in flexible packages (*e.g.*, bags and flexible film overwraps) that can adjust their shape to changing environmental conditions. However, flexible packages offer little, if any, protection from outside physical forces to the contained fragile food products. Thus, increasingly, a need to use more rigid containers has arisen.

While rigid containers constructed of paper and foil are well known in the art, their utilization in packaging fragile food products presents many inherent drawbacks. The

manufacturing costs of such rigid containers are relatively high. Moreover, in order to provide enough strength to resist forces induced by environmental change, the weight of such containers is relatively high. Additionally, changes in humidity can adversely affect the structural integrity of such containers.

Containers constructed of thermo-plastic substances are increasingly gaining in popularity for packaging fragile food products. However, packaging dry food products utilizing current thermo-plastic container technology is still problematic. While previous efforts have addressed the problems associated with utilizing thermo-plastic containers in packaging liquid products, these efforts have not addressed the inherent problems associated with packaging dry food products. Dry food products (*e.g.*, snack foods, baked goods and cereals) contain significantly larger amounts of entrapped gas, both within their structure as well as in their surrounding packaging, than do liquid products. The effect environmental changes impart on this larger volume of entrapped gas profoundly affects the packaging requirements of dry food products. Currently, thermo-plastic technology offers two basic alternatives for manufacturing plastic containers that adapt to or compensate for changing environmental conditions.

First, by increasing the thickness of the container's sidewall, a thermo-plastic container may be fashioned which is strong enough to resist forces induced by changing environmental conditions. However, such containers are generally undersirable in that they are expensive, in terms of materials, to manufacture and their weight is relatively high.

Alternatively, the thickness of a container's sidewall may be reduced so as to fashion a thermo-plastic container capable of adjusting its shape to changes in environmental conditions like a flexible package, but being sufficiently rigid to offer some protection from outside physical forces. However, such containers have significant commercial drawbacks. While it is currently possible to fashion a relatively thin walled thermo-plastic container that is capable of withstanding expansion forces resulting when the container's interior pressure is greater than the ambient pressure; such thin walled thermo-plastic containers tend to buckle, deform,

or implode in a generally unpredictable manner when the interior pressure is less than the ambient pressure (*e.g.*, the vacuum inducing manufacturing process discussed previously). Such deformation or implosion tends to detract from the commercial presentation of the container and often is interpreted as a damaged or defective product by purchasing consumers.

A variety of proposals have previously been made to circumvent the problems inherent in designing thermo-plastic containers capable of adapting to environmental changes. For Example, U.S. Patent No. 6,074,677 to Croft discloses a composite food container comprised of a vacuum packed inner flexible bag 60 and a rigid plastic tubular outer container 20. While the rigid plastic outer container 20 protects the container's contents, the differential between the vacuum in the inner flexible bag 60 and the vacuum in the region R between the inner bag and the outer container is sufficiently maintained so as to prevent the spoilage of the food product within the inner bag 60. However, such a container is both complicated and relatively expensive to manufacture.

Another prior proposal is U.S. Patent No. 5,921,429 to Gruenbacher *et al.* which discloses a substantially rectangular plastic container for multiple, side-by-side stacks of fragile food articles comprised of a single blow molded body. Key to the Gruenbacher *et al.* '429's design is the inclusion of an internal partition 16 having two spaced apart walls 26 and 28 which are adapted to deform in the presence of vacuum and pressure in the compartments such that the outer perimeter dimension of the container remains substantially the same and the wrap around labeling retains its fit. In addition to requiring a relatively complicated manufacturing process, the Gruenbacher *et al.* '429 design is not suited to packaging a single stack of fragile food articles.

A need, therefore, exists for an improved blow molded thermo-plastic container which is relatively simple to manufacture and strong enough to resist external compressive force, yet capable of adapting to changes in environmental conditions without adversely impacting the commercial presentation of the container.

SUMMARY OF THE INVENTION

The present invention overcomes many of the shortcomings inherent in previous containers for packaging potato chips, corn based chips, cookies and the like. The improved implosion-resistant container of the present invention utilizes a collection of stress dissipating mechanisms that counteract the forces causing thermo-plastic container deformation, implosion and loss of seal integrity. This collection of stress dissipating mechanisms, employed collectively or separately, allows a container for storing fragile food products to be fashioned as a relatively lightweight, thin-walled blow molded thermo-plastic container that is capable of adapting to changing environmental conditions while maintaining its visual aesthetic appearance

In one embodiment, structural rigidity mechanisms comprising molded ribs and "C" beams in a corrugated pattern traversing the longitudinal axis of the container are utilized to strengthen the structural integrity of the container. Alternatively, randomly spaced three-dimensional figures formed into the sidewall of the thermo-plastic container may also be employed as structural rigidity mechanisms.

In another embodiment, a floating panel mechanism is utilized which allows the internal gas volume to be accommodated without detracting from the commercial presentation of the container. The floating panel mechanism comprises a stable panel area defined by a flexible corrugated suspension ring formed within the confines of a planar surface fashioned in the curved sidewall of the container. The flexible corrugated suspension ring surrounding the stable panel area allows the entire stable panel area to move uniformly without randomly distorting or buckling the container.

In another embodiment, a morphing geometries mechanism is employed whereby an annular bellows means is formed in the tubular body of a container allowing the container to repeatedly increase or decrease its internal volume to counteract changing environmental conditions.

In another embodiment, a flowing geometries mechanism is employed which allows a container to smoothly change its geometry to counteract changes in environmental conditions thereby avoiding the random buckling and deformation inherent in current packaging techniques which detracts from the commercial

presentation of the container.

Thus, the present invention comprises numerous embodiments of thermoplastic, blow-molded containers that are capable of adapting to changing environmental conditions while maintaining their visual aesthetic appearance.

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BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

FIGS. 1*a*, 1*b*, 2*a*, and **2*b*** are perspective views of alternative embodiments of container of the present invention illustrating the employment of corrugated sides to induce structural rigidity;

FIG. 3 is a perspective view of the container of the present invention illustrating the employment of three-dimensional shape molding to induce structural rigidity;

FIG. 4*a* is a perspective view of the container of the present invention illustrating the employment of a floating panel mechanism;

FIG. 4*b* is a cross-sectional view of the container of the present invention illustrating the employment of a floating panel mechanism;

FIGS. 5*a* and **5*b*** are perspective views of the container of the present invention illustrating the employment of a morphing geometries mechanism;

FIG. 6*a* is a perspective view of the container of the present invention illustrating the employment of a flowing geometries mechanism;

FIG. 6*b* is a cut-away perspective view of the container of the present invention illustrating the employment of a flowing geometries mechanism; and

FIGS. 6*c* and **6*d*** are cross-sectional views of the container of the present invention illustrating the employment of a morphing geometries mechanism.

Where used in the various figures of the drawing, the same numerals designate the same or similar parts. Furthermore, when the terms "top," "bottom," "first," "second," "upper," "lower," "height," "width," "length," "end," "side," "horizontal," "vertical," and similar terms are used herein, it should be understood that these terms have reference only to the structure shown in the drawing and are utilized only to facilitate describing the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

The container of the present invention utilizes a collection of stress dissipating mechanisms that counteract the forces which cause container deformation, implosion and loss of seal integrity. This collection of stress dissipating mechanisms allows a container for storing fragile food products to be fashioned as a relatively lightweight, thin-walled blow molded thermo-plastic container that is capable of adapting to changing environmental conditions while maintaining its visual aesthetic appearance. The stress dissipating mechanisms employed are adaptable to container designs generally well known in the art. Thus, the various embodiments of the container of the present invention all have a generally tubular body comprising a sidewall permanently closed at one end comprising the container's base and having a sealable cap or lid. While employed collectively and/or separately, depending upon the circumstances of a specific product and its packaging requirements, the collection of stress dissipating mechanisms utilized in containers of the present invention may best be understood by examining each stress dissipating mechanism in isolation.

Structural Rigidity Mechanisms

Referring to **FIGS. 1*a***, **1*b***, **2*a***, **2*b*** and **4*a***, the use of molded ribs and "C" beams in a corrugated pattern traversing the longitudinal axis of the container may be employed to provide added strength throughout the container. Compressive and expansive forces are distributed over a larger area thereby resulting in a more structurally rigid container. The molded ribs and corrugated "C" beams may be either annular or non-annular. Thus, in one embodiment, as illustrated in **FIGS. 1*a*** and **1*b***, the corrugated "C" beams **10** are generally annular and perpendicular to the longitudinal axis of the container. In another embodiment, as illustrated in **FIGS. 2*a*** and **2*b***, the corrugated "C" beams **20**, while generally annular, traverse the longitudinal axis of the container in a wavy sinusoidal pattern. Alternatively, in another embodiment, as shown in **FIG. 4*a***, non-annular ribs **40** may be formed into selected areas of a container.

Where applicable, the container may also include a smooth surface area between corrugated sections. Thus, as shown in the embodiment of a container

illustrated in FIG. 1*b*, an upper corrugated section **12***a* and the lower corrugated section **12***b* are separated by a smooth section **14** that is suitable for attaching a label **16**. Similarly, in another embodiment of the container illustrated in FIG. 2*b*, a smooth section **24** that is suitable for attaching a label **26** separates the upper wavy corrugated section **22***a* and the lower wavy corrugated section **22***b*.

Referring now to FIG. 3, in another embodiment of the present invention, randomly spaced three-dimensional figures **30***a-j* formed into the sidewall of a thermo-plastic container may be employed to provide added strength throughout the container. The randomly spaced three-dimensional figures **30***a-j* distribute compressive and expansive forces over a larger area thereby resulting in a more structurally rigid container. It is understood that the geometric three-dimensional figures **30***a-j* illustrated in FIG. 3 are shown to merely illustrate the concept and not to limit it. Thus, any three-dimensional figure design formed into the sidewall of a thermo-plastic container may be suitable in the appropriate circumstance. Additionally, the three-dimensional figures may also be evenly spaced for aesthetic purposes.

Floating Panel Mechanism

Referring now to FIGS. 4*a* and 4*b*, an embodiment of the present invention is illustrated which utilizes a floating panel mechanism. The floating panel mechanism comprises a stable panel area **42** defined by an encompassing flexible corrugated suspension ring **44** formed within the confines of a planar surface **46** fashioned in the curved sidewall **48** of the container. The flexible corrugated suspension ring **44** surrounding the stable panel area **42** allows the entire stable panel area **42** to move uniformly (*i.e.*, springs in and out) without randomly distorting or buckling the container. Other portions of the container may be sufficiently reinforced (*e.g.*, using corrugated ribs **40**) so that all container expansion and contraction is accomplished by the floating panel mechanism. The stable panel area **42** springs out and retracts in a direction perpendicular to the planar surface **46**. Thus, changes in the internal gas volume may be accommodated without detracting from the commercial presentation of the container.

Morphing Geometries Mechanism

Referring now to **FIGS. 5*a*** and **5*b***, an embodiment of the present invention is shown which illustrates the utilization of a morphing geometries mechanism. The structure of a morphing geometries mechanism comprises an annular bellows means **54** formed in the tubular body **50** of the container. The annular bellows means **54** expands (shown in **FIG. 5*a***) and contracts (shown in **FIG. 5*b***) along the container's longitudinal axis allowing the container to repeatedly increase or decrease its internal volume to counteract changing environmental conditions. While the embodiment illustrated in **FIGS. 5*a*** and **5*b*** positions the annular bellows means **54** near the top of the container's tubular body, it is understood that in appropriate circumstances, the annular bellows means **54** may be positioned anywhere along the entire longitudinal length of the container's tubular body.

Flowing Geometries Mechanism

Referring now to **FIGS. 6*a*** and **6*b***, an embodiment of the present invention is shown which illustrates the utilization of a flowing geometries mechanism. Flowing geometries mechanism are designed allow a container to smoothly change its geometry to counteract changes in environmental conditions thereby avoiding the random buckling and deformation inherent in current packaging techniques which detracts from the commercial presentation of the container. In a preferred embodiment, the flowing geometries mechanism comprises one or more lateral flexible hinge areas (*e.g.*, **62** and **64**) formed in the sidewall of the container **60** and defining a weakened panel area **68** there between. The lateral flexible hinge areas **62** and **64** effectively control the deformation of the container in response to changes in environmental conditions by allowing the container to contract and expand the weakened area **68** in a smooth and uniform manner. While the container's geometry or shape is allowed to smoothly adjust to changes in environmental conditions, the deformation is controlled such that the commercial presentation of the container is not detracted from.

Referring now to **FIGS. 6*b*** - **6*d***, in one embodiment of a container utilizing a flowing geometries mechanism, the container is designed so that a small annular

space exists between the outer periphery of the enclosed product stack **66** and the weakened panel area **68** of the container **60** so as to aid in the manufacturing and packaging process. The size of the container may be designed such that the inner wall of the weakened panel area **68** contacts the outer periphery of the enclosed product stack **66** when the container contracts, thereby limiting the amount of controlled deformation. The enclosed product stack **66** may actually provide some measure of lateral structural support to the sidewall of the container when the internal pressure of the container is less than the ambient atmospheric pressure.

It will now be evident to those skilled in the art that there has been described herein an improved container for storing fragile food products, and more particularly, to an improved blow molded container for storing potato chips, corn based chips, cookies and the like which is capable of adapting to changing environmental conditions while maintaining its visual aesthetic appearance. Although the invention hereof has been described by way of a preferred embodiment, it will be evident that other adaptations and modifications can be employed without departing from the spirit and scope thereof. For example, multiple stress dissipating mechanisms may be utilized in a single container. Additionally, while the containers of the present invention illustrated in the Figures have a generally circular traverse cross section, it is understood that the collection of stress dissipating mechanisms utilized in containers of the present invention may be employed on any containers having a generally annular traverse cross section. Thus, in addition to containers having a circular traverse cross-section, alternative embodiments of the container of the present invention may have a traverse cross section which is generally oval in shape. The terms and expressions employed herein have been used as terms of description and not of limitation; and thus, there is no intent of excluding equivalents, but on the contrary it is intended to cover any and all equivalents that may be employed without departing from the spirit and scope of the invention.

CLAIMS:

What is claimed is:

1. A thermo-plastic container for packaging a single stack of fragile articles, comprising:

a generally tubular body with a central longitudinal axis, said body having a sidewall, a closed end and an open end; wherein said sidewall includes a corrugated pattern formed therein.

2. The container of Claim 1 wherein the corrugated pattern is annular.

3. The container of Claim 1wherein the pattern is non-annular.

4. The container of Claim 1 wherein the corrugated pattern traverses the central longitudinal axis.

5. The container of Claim 1 wherein the corrugated pattern traverses the central longitudinal axis at a perpendicular angle.

6. The container of Claim 1 wherein the corrugated pattern traverses the central longitudinal axis in a sinusoidal pattern.

7. The container of Claim 1 wherein the sidewall further includes a smooth section formed therein.

8. A thermo-plastic container for packaging a single stack of fragile articles, comprising:

a generally tubular body with a central longitudinal axis, said body having a sidewall, a closed end and an open end; wherein said sidewall includes a plurality of three-dimensional shapes formed therein.

9. The container of Claim 8 wherein the sidewall further includes a corrugated pattern formed therein.

10. A thermo-plastic container for packaging a single stack of fragile articles, comprising:

a generally tubular body with a central longitudinal axis, said body having a sidewall, a closed end and an open end; wherein said sidewall includes a floating panel mechanism formed therein.

11. The container of Claim 10 wherein the floating panel mechanism comprises a stable panel area defined by an encompassing flexible corrugated suspension ring formed within the confines of a planar surface fashioned in the sidewall.

12. The container of Claim 10 wherein the sidewall further includes a corrugated pattern formed therein.

13. The container of Claim 10 wherein the sidewall further includes a plurality of three-dimensional shapes formed therein.

14. The container of Claim 12 wherein the sidewall further includes a plurality of three-dimensional shapes formed therein.

15. A thermo-plastic container for packaging a single stack of fragile articles, comprising:

a generally tubular body with a central longitudinal axis, said body having a sidewall, a closed end and an open end; wherein said tubular body includes a morphing geometries mechanism formed therein.

16. The container of Claim 15 wherein the morphing geometries mechanism comprises an annular bellows means.

17. The container of Claim 15 wherein the sidewall further includes a corrugated pattern formed therein.

18. The container of Claim 17 wherein the sidewall further includes a plurality of three-dimensional shapes formed therein.

19. The container of Claim 17 wherein the sidewall further includes a floating panel mechanism formed therein.

20. The container of Claim 19 wherein the sidewall further includes a plurality of three-dimensional shapes formed therein.

21. The container of Claim 15 wherein the sidewall further includes a plurality of three-dimensional shapes formed therein.

22. The container of Claim 21 wherein the sidewall further includes a floating panel mechanism formed therein.

23. The container of Claim 15 wherein the sidewall further includes a floating panel mechanism formed therein.

24. A thermo-plastic container for packaging a single stack of fragile articles, comprising:

a generally tubular body with a central longitudinal axis, said body having a sidewall, a closed end and an open end; wherein said sidewall includes a flowing geometries mechanism formed therein.

25. The container of Claim 24 wherein the flowing geometries mechanism comprises at least one lateral flexible hinged area defining a weakened panel area.

26. The container of Claim 24 wherein the flowing geometries mechanism comprises at least two flowing geometries mechanisms evenly spaced around the annular periphery of the body.

27. The container of Claim 24 wherein sidewall further includes a corrugated pattern formed therein.

28. The container of Claim 27 wherein the sidewall further includes a plurality of three-dimensional shapes formed therein.

29. The container of Claim 27 wherein the sidewall further includes a floating panel mechanism formed therein.

30. The container of Claim 27 wherein said tubular body includes a morphing geometries mechanism formed therein.

31. The container of Claim 24 wherein the sidewall further includes a plurality of three-dimensional shapes formed therein.

32. The container of Claim 31 wherein the sidewall further includes a floating panel mechanism formed therein.

33. The container of Claim 32 wherein sidewall further includes a corrugated pattern formed therein.

34. The container of Claim 31 wherein said tubular body includes a morphing geometries mechanism formed therein.

35. The container of Claim 34 wherein sidewall further includes a corrugated pattern formed therein.

36. The container of Claim 24 wherein the sidewall further includes a floating panel mechanism formed therein.

37. The container of Claim 36 wherein said tubular body includes a morphing geometries mechanism formed therein.

38. The container of Claim 37 wherein the sidewall further includes a plurality of three-dimensional shapes formed therein.

39. The container of Claim 38 wherein sidewall further includes a corrugated pattern formed therein.

40. The container of Claim 24 wherein said tubular body includes a morphing geometries mechanism formed therein.

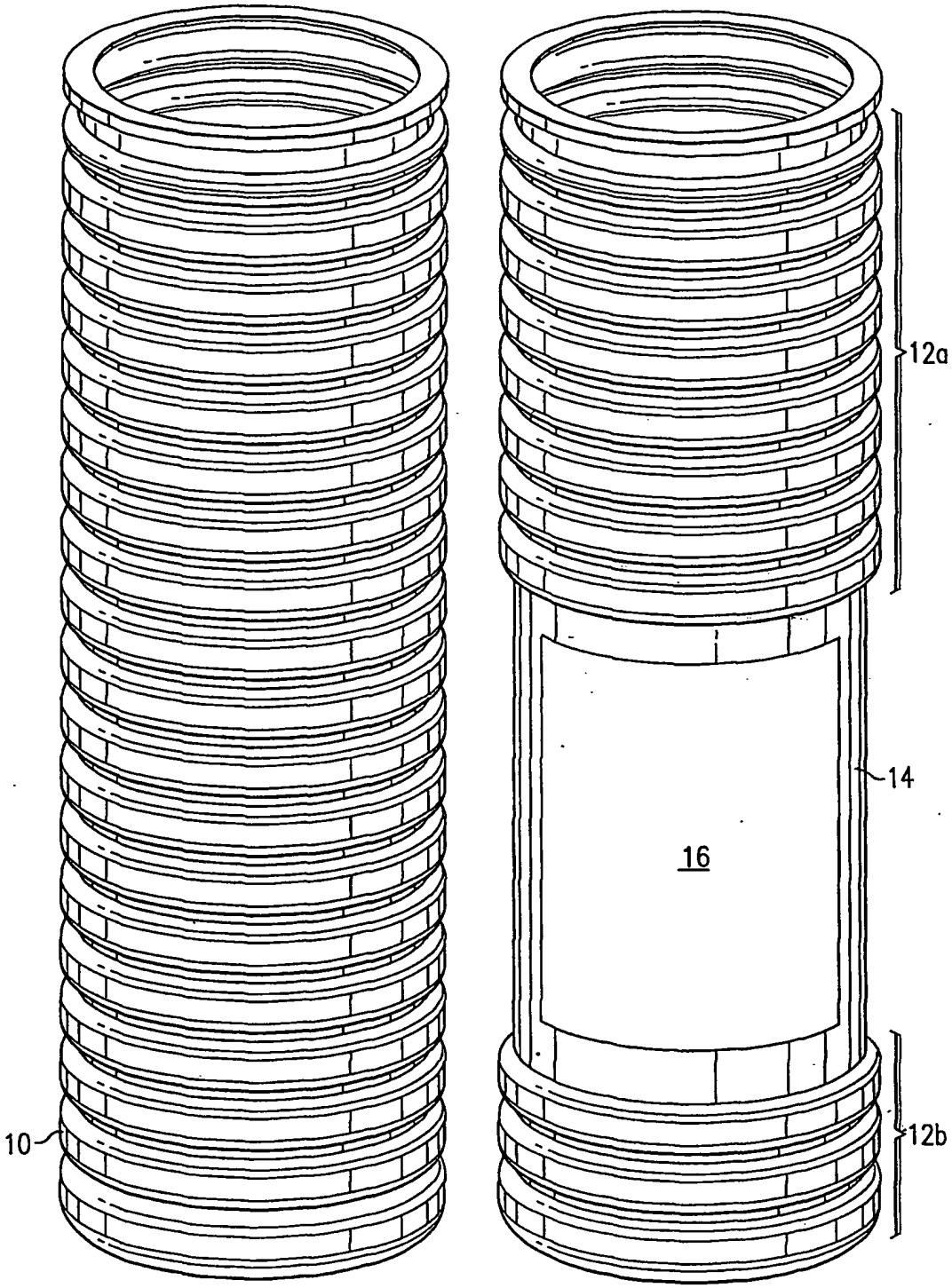

FIG. 1A FIG. 1B

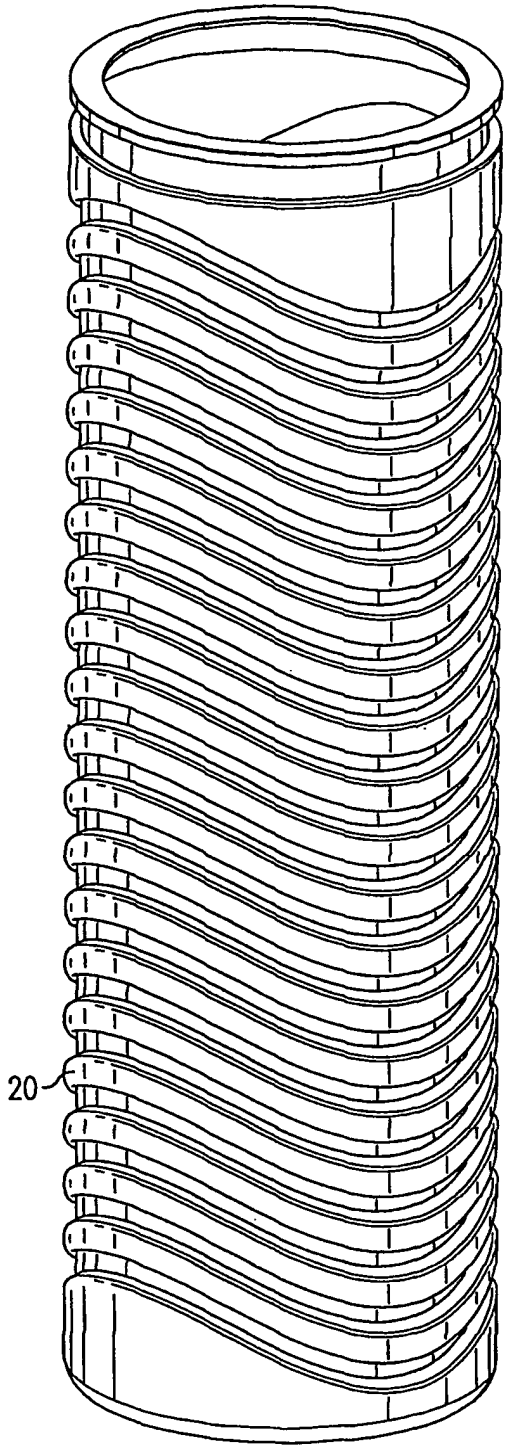

FIG. 2A

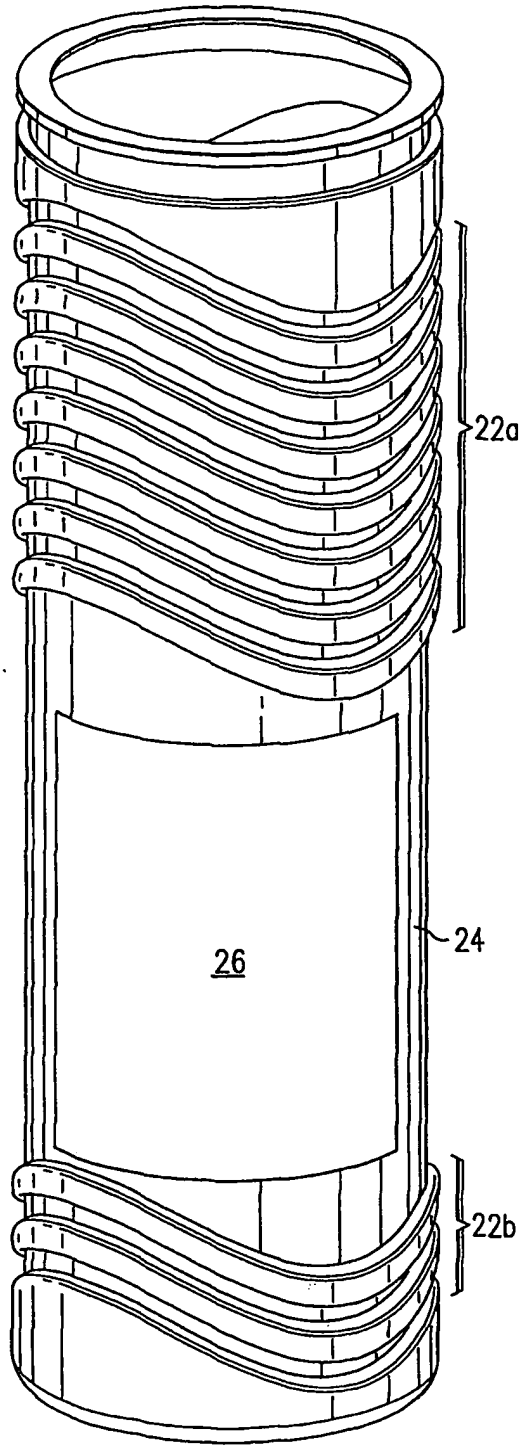

FIG. 2B

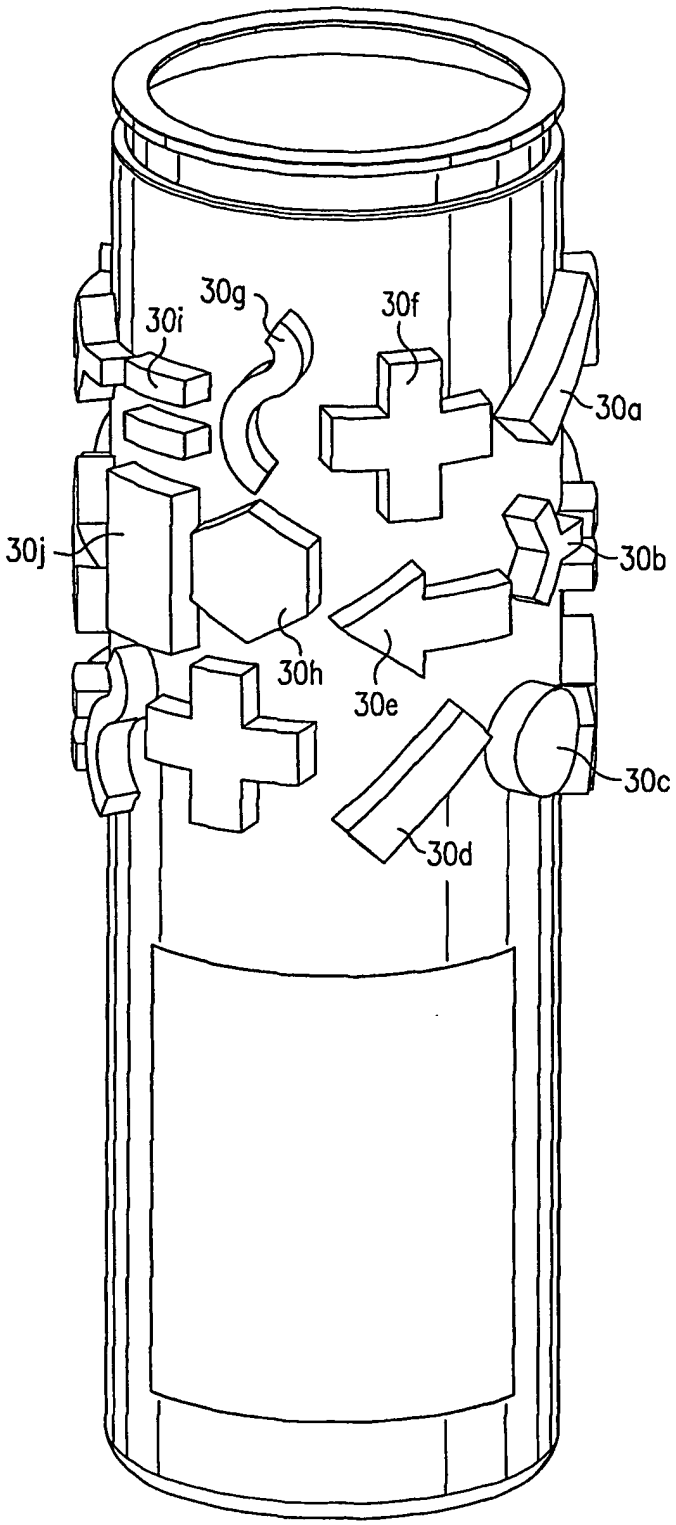

FIG. 3

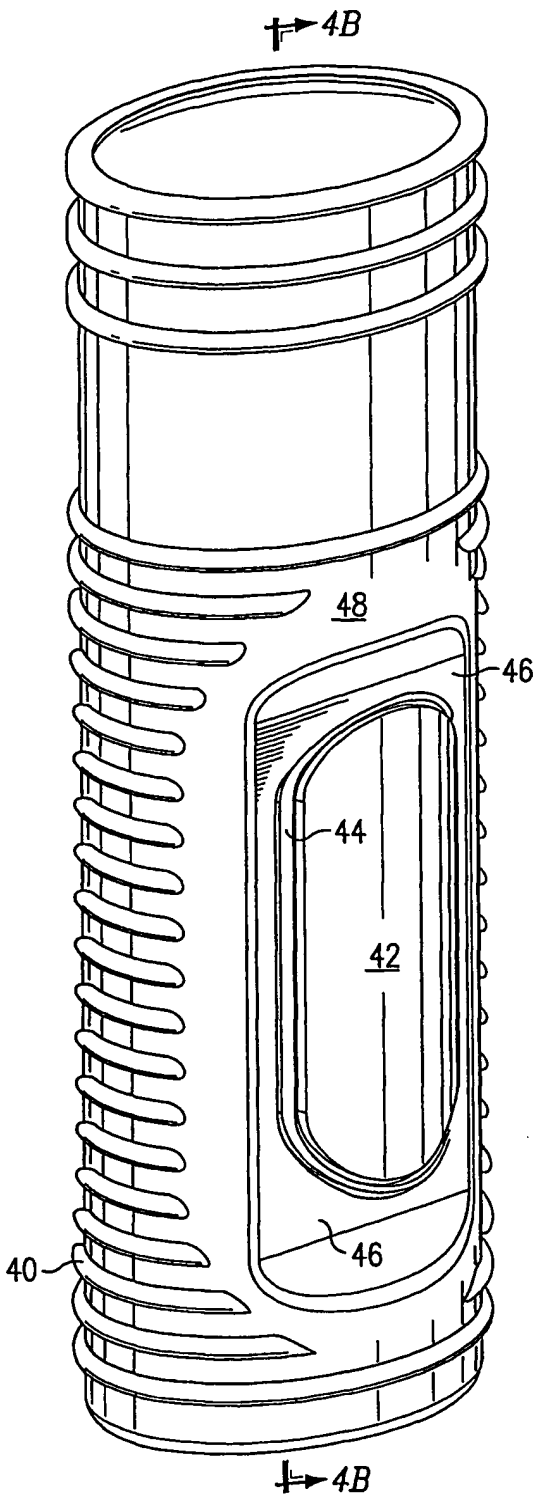

FIG. 4A

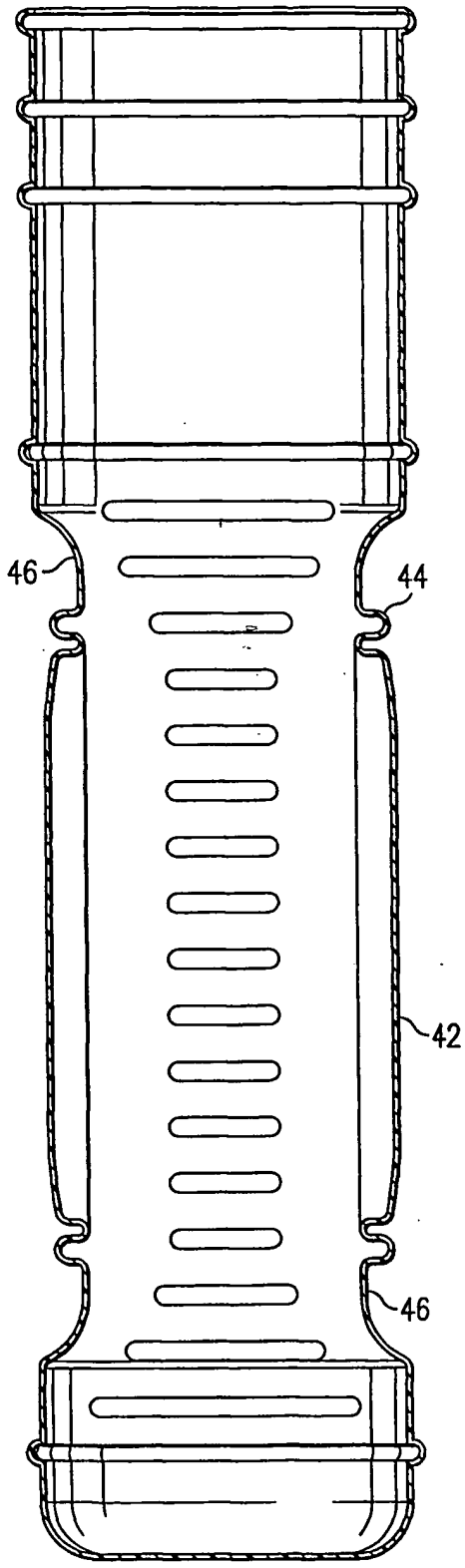

FIG. 4B

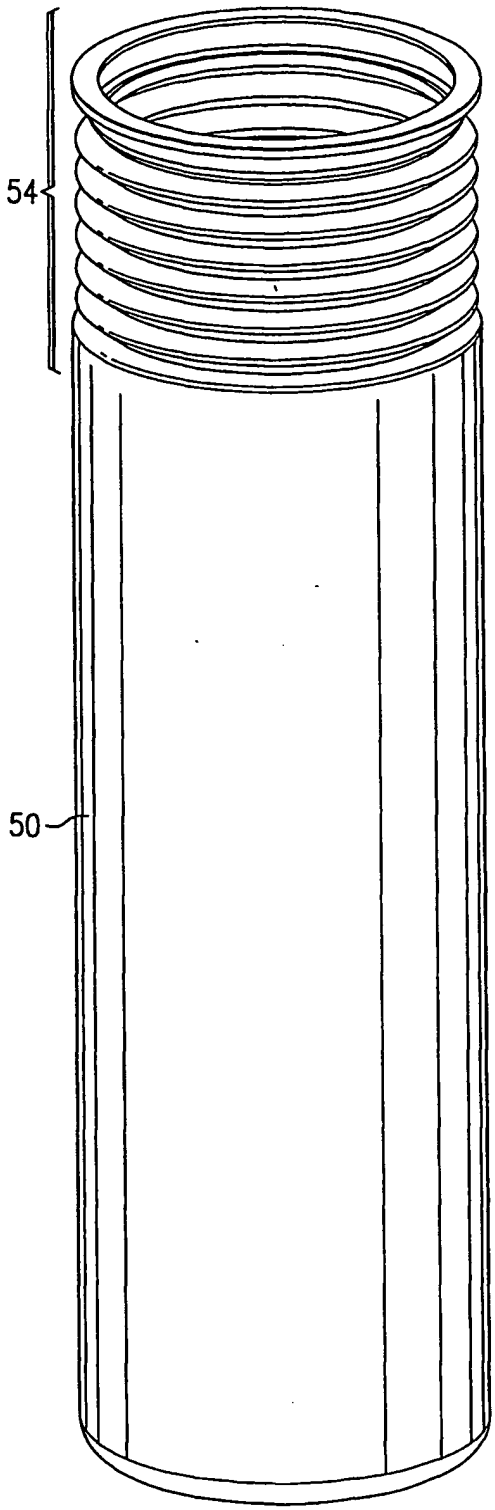

FIG. 5A

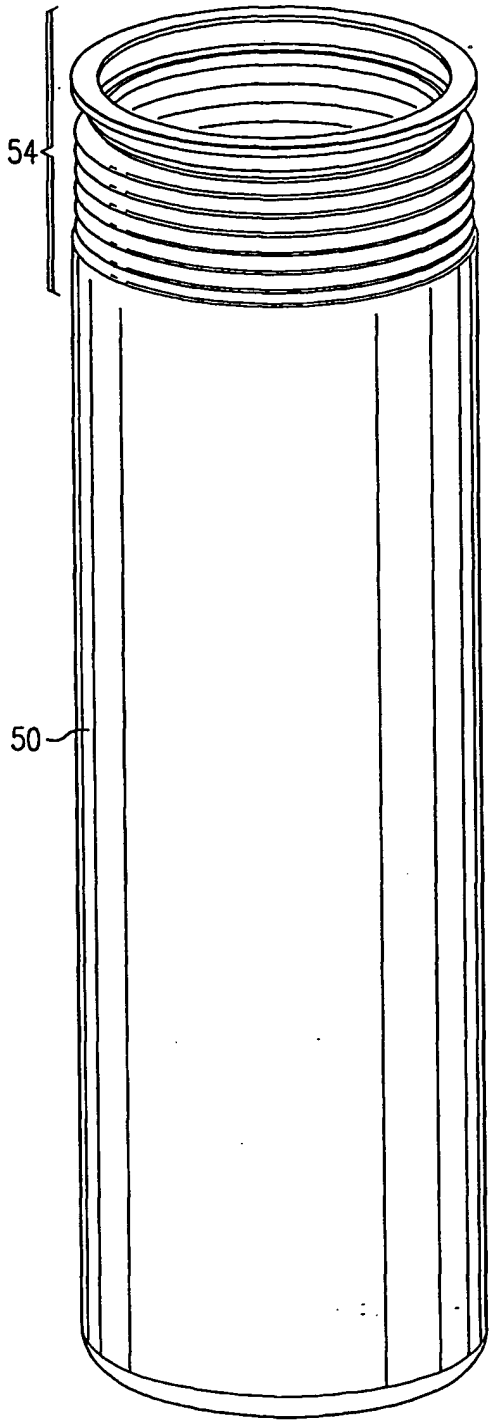

FIG. 5B

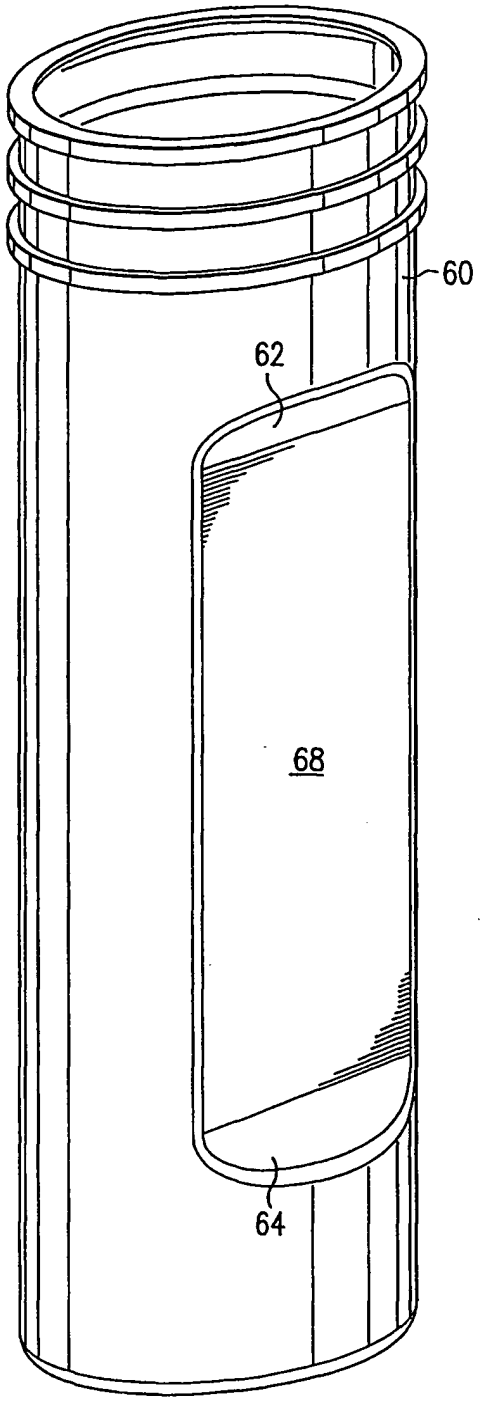

FIG. 6A

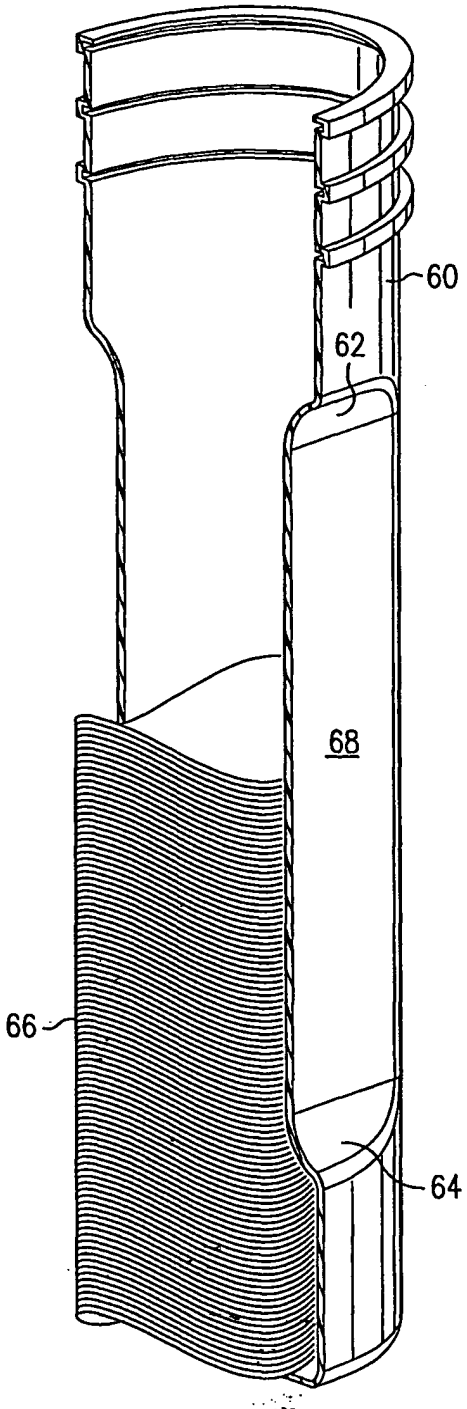

FIG. 6B

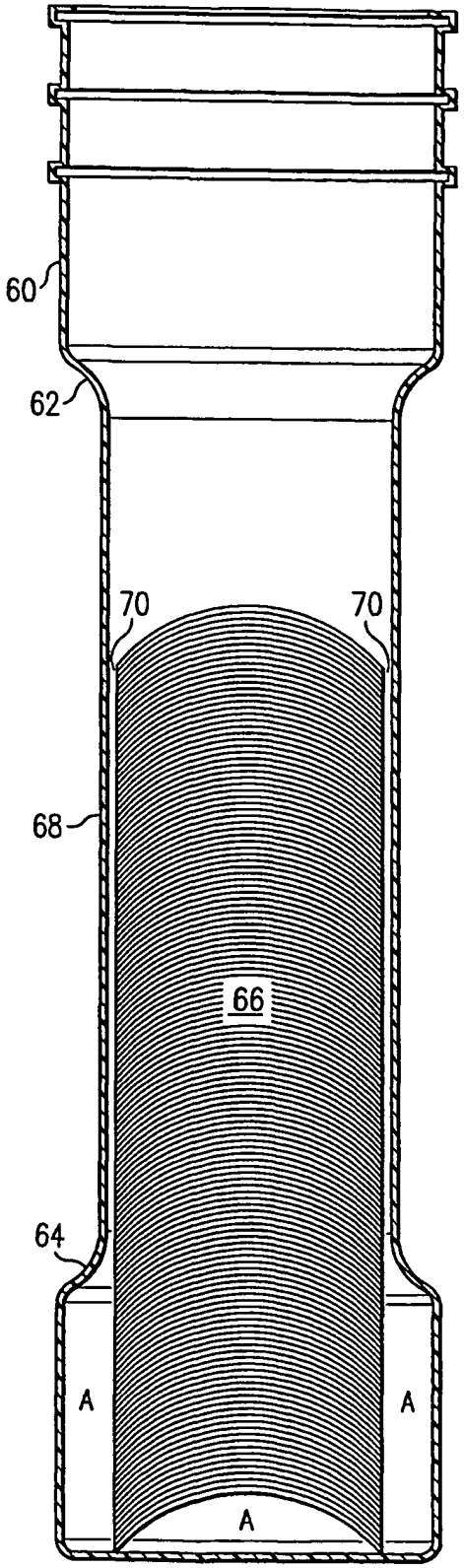

FIG. 6C

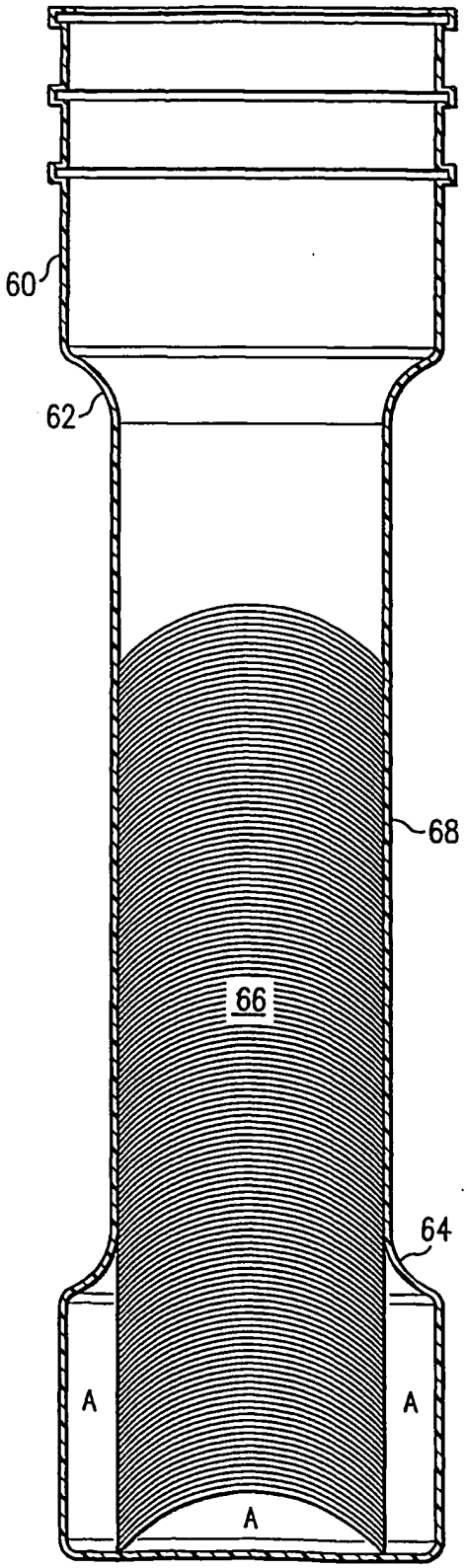

FIG. 6D